

Some Phases of Federal Plant Quarantine Work in Hawaii

By RICHARD FAXON

United States Department of Agriculture
Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

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To plant quarantine inspectors the entomological history of Hawaii presents many elements of interest. In addition to the classic examples of biological control of insects, and important taxonomic studies, pioneer work was done in protecting the agriculture and forests of Hawaii from plant diseases and injurious insects by the enforcement of quarantine laws. Under the monarchy a Bureau of Agriculture and Forestry was established in the Department of Interior. One of its objects was "to guard against the introduction of plant diseases or insect pests, and to render aid in the suppression of blights and diseases affecting agricultural products and live stock". The Session Laws of 1888 included "An Act to Prevent the Introduction of Coffee Leaf Diseases" and in 1890 "An Act Relating to the Suppression of Plant Diseases, Blight and Insect Pests". The Penal Laws of the Republic (1896) provided for the reporting through customs officers of the presence of plants on board ships from foreign ports and the inspection and disposition of such plants by the Commissioners of Agriculture. The present Territorial law places responsibility for enforcing plant quarantine regulations in the Board of Commissioners of Agriculture and Forestry through its division of entomology.

THE MEDITERRANEAN FRUIT FLY IN HAWAII

The melon fly (*Dacus cucurbitae* Coq.) had been in the Hawaiian Islands for many years and the discovery of the Mediterranean fruit fly (*Ceratitidis capitata* [Wied.]) in 1910 added another serious pest of this type. As these fruit flies were of great concern to fruit growers, the Board of Commissioners of Agriculture and Forestry on October 6, 1910, requested E. M. Ehrhorn, superintendent of entomology, to notify the California Horticultural Commission of the appearance of the Mediterranean fruit fly on Oahu. About a year later, November 1, 1911, the Board appointed Walter M. Giffard director of fruit fly control, and in December 1911, California sent H. A. Weinland to Hawaii as an inspector to aid in reducing the danger fruit fly introduction in that state. A vigorous

campaign was carried on to reduce the fruit fly population and to prevent its spread. Notwithstanding these efforts, the Mediterranean fruit fly had been found on all the other larger islands, except Lanai, by the end of 1912.

In 1912 Congress appropriated \$35,000 for the study of the Mediterranean fruit fly and E. A. Back, of the Bureau of Entomology, United States Department of Agriculture, was designated to take charge of the investigation of this insect in Hawaii. He arrived in Hawaii on August 29, 1912, accompanied by C. L. Marlatt, assistant chief of the Bureau, and also chairman of the Federal Horticultural Board. Dr. Back took over the work on the Mediterranean fruit fly in the Territory on September 15, 1912, except the collection and introduction of parasites. The Territory had employed F. Silvestri to aid in collecting such material. After conferring with W. M. Giffard, president of the Board of Commissioners of Agriculture and Forestry, and E. M. Ehrhorn, superintendent of entomology, Dr. Marlatt, as chairman of the Federal Horticultural Board, recommended the appointment of Mr. Ehrhorn as collaborator of the latter Board with the Secretary of Agriculture. His appointment on December 1, 1912, gave Mr. Ehrhorn authority to enforce the Federal Plant Quarantine Act of August 20, 1912, and the foreign quarantines promulgated under its provisions. The same arrangement has been carried on with Mr. Ehrhorn's successors, L. A. Whitney and Noel L. H. Krauss, as plant quarantine officers for the Territory.

FEDERAL QUARANTINES AFFECTING TRAFFIC BETWEEN HAWAII AND THE MAINLAND

The development of Federal quarantines affecting traffic in plants and plant products between Hawaii and the other parts of the United States, under the provisions of the Plant Quarantine Act, required a period of many years. The following list is effective at present: Quarantine No. 13, Mediterranean Fruit fly and Melon fly; Quarantine No. 16, Sugarcane; Quarantine No. 30, Sweet-potato and Yam; Quarantine No. 32, Banana Plant; Quarantine No. 47, Hawaiian and Porto Rican Cotton, Cottonseed, and Cottonseed Products; Quarantine No. 51, Sugarcane; Corn, Cotton, Alfalfa, and Fruits of Avocado and Papaya from the United States to Hawaii; Quarantine No. 60, Sand, Soil, or Earth, with Plants.

Quarantine No. 13: Very soon after Dr. Back took over fruit fly investigations in Hawaii, the Secretary of Agriculture promulgated Notice of Quarantine No. 2 on September 18, 1912. This order prohibited the entry into the mainland of Mediterranean fruit fly hosts from Hawaii. (Only bananas and pineapples were permitted to enter California from Hawaii under Quarantine Order No. 6 of the California Commission of Horticulture.) Notice of

Quarantine No. 2 was superseded by Quarantine No. 13, effective May 1, 1914, which mentions both the Mediterranean fruit fly and the melon fly as causes for quarantine action. In its original form Quarantine No. 13 prohibited the movement from the Territory of Hawaii into the rest of the United States of any fruit or vegetable upon which either the Mediterranean fruit fly or the melon fly breeds. Bananas and pineapples were included in an extensive list of such hosts, but provision was made by regulation for shipment of these two fruits after inspection and certification by the United States Department of Agriculture as free from infestation with the two fruit flies in question. The quarantine was amended several times in order to clarify the regulations and to expand the list of fruit and vegetables that could be shipped after inspection and certification. The first additions to the permitted list were taro and coconuts. Later lily root, ginger root, and "gobo", or burdock (*Arctium lappa*), were added. The present revision of Quarantine No. 13 became effective June 1, 1917. It prohibits the movement of all fruits and vegetables in the natural or raw state from the Territory, except in manner or method or under conditions prescribed in regulations of the Secretary of Agriculture. Under revised rules and regulations effective June 1, 1930, six fruits and vegetables are permitted shipment under certification: Bananas of the noncooking type, pineapples, taro, coconuts, lily root, and ginger root. Provision is made for the certification of other fruits and vegetables that cannot be the means of conveying either the Mediterranean fruit fly or the melon fly. Under this provision 40 fruits and vegetables have been added to the six listed in the revision of 1930. The complete list is as follows: Arrowhead (*Sagittaria sagittifolia*), arrowroot (*Maranta arundinacea*), asparagus (*Asparagus officinalis*), bean sprouts, mung (*Phaseolus aureus*), bean sprouts, soy (*Glycine hispida*), burdock, great (*Arctium lappa*, *Lappa major*, *L. edulis*), butterbur (*Petasites japonica*), cabbage (*Brassica oleracea*, *B. pekinensis*, *B. chinensis*), carrot (*Daucus carota*), cassava (*Manihot* sp.), celery (*Apium graveolens*), Chinese spinach (*Amaranthus gangeticus*), chives (*Allium schoenoprasum*), chrysanthemum, garland (*Chrysanthemum coronarium*), coriander (*Coriandrum sativum*), dandelion (*Taraxacum officinale*), dropwort, water (*Oenanthe stolonifera*), garlic (*Allium sativum*), ginger bracts (*Zingiber mioga*), honewort (*Cryptotaenia canadensis*), Jesuit's nut (*Trapa bicornis*, *T. natans*), kudzu (*Pueraria thunbergiana*), leek (*Allium porrum*), lettuce (*Lactuca sativa*), Malabar-nightshade (*Basella rubra*), mugwort (*Artemisia vulgaris*), onion, green (*Allium fistulosum*), parsley (*Petroselinum hortense*), pea, edible podded (*Pisum sativum macrocarpon*), perilla (*Perilla frutescens*), potato (*Solanum tuberosum*), radish (*Raphanus sativus longipinnatus*), spinach (*Spinacia oleracea*), swamp cabbage (*Ipomoea reptans*), sweetcorn (*Zea mays*), taro

root, shoots and stalks (*Colocasia esculenta*), watercress (*Nasturtium officinale*), waternut (*Eleocharis tuberosa*) or waterchestnut (*Scirpus tuberosus*), yambean root (*Pachyrhizus erosus*), yams (*Dioscorea* spp.).

A number of violations of Quarantine No. 13, one as late as 1930, resulted in fines for the offenders and valuable publicity in the enforcement of the quarantine. The Post Office Department was also very helpful in notifying the postmasters in the Territory of the requirements of the quarantine order.

Administrative Instructions have been issued under the provisions of Quarantine No. 13 for various treatments of prohibited fruits and vegetables in Hawaii under supervision of Bureau inspectors. B.E.P.Q.-481, effective November 1, 1938, outlines two treatments, refrigeration at 35° F. for 15 days, or heating in saturated air at 110° F. for 8 hours. B.E.P.Q.-510, effective August 1, 1940, provides for the certification of guavas, papayas, bell peppers, bitter melon, cucumbers, summer squash, string beans, and tomatoes, for shipment to the mainland, after fumigation with methyl bromide for 3½ hours, at a dosage of 2 pounds to 1,000 cu. ft. and temperature not lower than 80° F. B.E.P.Q.-462, effective September 15, 1937, includes frozen-pack fruits from Hawaii in its provisions. Shipments may be made only under permits issued in advance. Fruits subject to attack by plant pests not killed by the refrigeration treatment prescribed may not be authorized for shipment. Fruits must be frozen solid before or after packing and their temperatures must be 20° or below at the time of arrival.

Quarantine No. 16: The domestic sugarcane quarantine, Notice of Quarantine No. 16, was issued June 6, 1914, and was effective on the same date. On account of certain injurious insects and fungous diseases existing in Hawaii and Puerto Rico, the movement of living canes of sugarcane, or cuttings or parts thereof, to the mainland was declared unlawful. With the change in the foreign sugarcane quarantine No. 15 to include bagasse in addition to living canes and its extension to protect Hawaii and Puerto Rico, the domestic sugarcane quarantine No. 16 was revised, effective January 1, 1935, to include bagasse as well as canes of sugarcane, cuttings, or parts thereof, or sugarcane leaves as prohibited material. Provision was made for the importation of the prohibited articles by the United States Department of Agriculture for scientific or experimental purposes, and the entry of specific materials under permit when authorized by the Department. Under this proviso numerous shipments of bagasse have been permitted from Hawaii for investigational and manufacturing purposes when their movement involves no pest risk.

Quarantine No. 30: After the customary hearing, the domestic quarantine on sweetpotatoes and yams was adopted and became

effective January 1, 1918. This quarantine prohibited the movement of the two vegetables from Hawaii and Puerto Rico to the mainland, and was promulgated on account of the presence of two insects in Hawaii and Puerto Rico, i.e., *Cylas formicarius* (Fabr.) and *Euscepes batatae* * (Waterh.) which has been reported as infesting sweetpotatoes (*Ipomoea batatas*) and yam (*Dioscorea* spp.). A revision of Quarantine No. 30, approved October 4, 1934 (effective October 10, 1934), removed the prohibition against the movement of *Dioscorea* spp., and the sweetpotato stem borer (*Omphisa anastomosalis* [Guen.]) was added to the sweetpotato scarabee (*Euscepes batatae**) as a reason for quarantine action.

Quarantine No. 32: After a public hearing held on March 4, 1918, Notice of Quarantine No. 32, Banana Plant Quarantine (Domestic), was issued, effective April 1, 1918. This quarantine prohibits the movement of any species of banana plants from Hawaii and Puerto Rico to the mainland, on account of the existence of two weevils which attack banana plants and sugar cane: *Rhabdocnemis obscura*† (Bdv.) in Hawaii and *Metamasius hemipterus* (Linn.) in Puerto Rico. Provision is made for importations of banana plants by the United States Department of Agriculture for experimental purposes. The quarantine does not affect the shipment of the fruit of the noncooking type of bananas from Hawaii.

Quarantine No. 47: The restriction on the movement of cottonseed and cottonseed hulls from Hawaii was first issued on June 24, 1913, as Notice of Quarantine No. 9. Later Quarantine No. 23 was promulgated on February 11, 1916, which regulated the movement of cotton from Hawaii into any part of the United States. These earlier quarantines were superseded by Quarantine No. 47, effective August 15, 1920, which regulates the movement of Hawaiian and Puerto Rican cotton, cottonseed, and cottonseed products. In addition to the pink bollworm (*Pectinophora gossypiella* [Saund.]), which was the basis for the earlier quarantine action against Hawaiian cotton, the cotton blister mite (*Eriophyes gossypii* Banks), another pest of cotton, was known to exist in Puerto Rico. The regulations prohibit the entry into the mainland of the United States of Hawaiian and Puerto Rican seed cotton, cottonseed, and cottonseed hulls. Ginned cotton, cottonseed cake, meal, and other cottonseed products from Hawaii and Puerto Rico may be shipped under permit issued by the Secretary of Agriculture, but are permitted to enter only through the ports of New York, Boston, San Francisco, and Seattle, or other port designated in the permit. Cotton is allowed to enter only by an all-water route. The importation of cottonseed oil from Hawaii and Puerto Rico is unrestricted.

*Now known as *Euscepes postfasciatus* (Fairm.) [Ed.].

†*Rhabdoscelus* Marshall (1943) is now the accepted name for this genus of beetles [Ed.].

Quarantine No. 51: In order to protect Hawaii from a number of injurious insects known to infest certain crops on the mainland, Quarantine No. 51 was promulgated, effective October 1, 1921. The following insects were listed in the quarantine as potential pests of Hawaiian crops: The sugarcane moth borer (*Diatraea saccharalis* [Fabr.]), the alfalfa weevil (*Hypera postica* [Gyll.]), the cotton boll weevil (*Anthonomus grandis* Boh.), the papaya fruit fly (*Toxotrypana curvicauda* Gerst.) and certain insects attacking the fruit of the avocado. The regulations restrict the movement of sugarcane, corn, cotton, and alfalfa plants or parts thereof, and the fruits of avocado and papaya. When carried as ship's stores, or by passengers and crews on coastwise ships en route to Hawaii, they must be consumed or removed from such ships before arrival at Hawaiian ports, and the ships must be sterilized.

Quarantine No. 60: The restriction of the movement of sand, soil, or earth from Hawaii and Puerto Rico to the mainland was first considered at a public hearing on March 7, 1922. Quarantine action was considered necessary because of the existence in those islands of several beetles and termites, which might be carried in soil with plants. Action was delayed, however, and the Hawaiian and Puerto Rican Quarantine covering sand, soil, or earth, with plants, Quarantine No. 60, became effective March 1, 1926. It was revised effective September 1, 1936. This quarantine prohibits the shipment of sand (other than clean ocean sand), soil, or earth, around the roots of plants, from Puerto Rico and Hawaii to the mainland of the United States because the following insects might be transported in such material: *Phyllophaga* spp. (white grubs), *Phytalus* sp., *Adoretus* sp., and several species of termites, or white ants. Numerous shipments of soil free from roots of plants and other plant material, and free from all stages of insects, have been allowed to move from Hawaii to the mainland for experimental purposes. The shippers have cooperated in safeguarding all such shipments from possible insect infestation.

APPLICATION OF QUARANTINES

The application of the quarantines just described has been a gradual development. It has had several phases such as the certification of fruits and vegetables after inspection, and later after treatment, the inspection of parcel-post packages before they leave Honolulu for the mainland, and the inspection and certification of airplanes before departure to the West Coast of the United States. Inspections have been made of express packages also and of hold baggage on departing ships.

Certification of Hawaiian fruits and vegetables, in accordance with the provisions of Quarantine No. 13, was carried on by E. A. Back and C. E. Pemberton, of the Bureau of Entomology, United

States Department of Agriculture, in conjunction with the investigations of the Mediterranean fruit fly and the melon fly. This work was transferred from the Bureau to the Federal Horticultural Board when H. F. Willard became an officer of the Board in 1928. At the beginning, bananas and pineapples were the only fruits certified. As already stated, the list of fruits and vegetables was expanded in accordance with the demand on the part of shippers, and when it could be determined that there was no risk of transporting fruit flies with the products in question. Inspections in the field naturally increased to determine whether the fruits and vegetables were being properly handled to avoid contamination with possible sources of fruit fly infestation. The inspections included the survey of adjacent premises, as well as packing houses, packing material, and the fruits and vegetables that were permitted entry.

Refrigeration treatment for Hawaiian fruits to kill the eggs, larvae, and pupae of the Mediterranean fruit fly was first proposed by E. A. Back in 1916. Extensive experiments were conducted by Dr. Back and C. E. Pemberton from 1916 to 1918 with Hawaiian fruits at various temperatures. Results showed that "no stage of the Mediterranean fruit fly can survive refrigeration for seven weeks at 40° to 45° F., for three weeks at 33° to 40° F., or for two weeks at 32° to 33° F."¹

Heat treatment was developed in Florida during the campaign against the Mediterranean fruit fly and was studied further under Hawaiian conditions at the fruit fly laboratory of the Bureau of Entomology and Plant Quarantine and the Hawaii Agricultural Experiment Station at Honolulu. Administrative instructions in B.E.P.Q.-481, effective November 1, 1938, authorized the sterilization of Hawaiian fruits and vegetables by cooling until the approximate center of the fruit or vegetable reaches 35° F. and holding it at that temperature for 15 days, or heating until the approximate center reaches 110° F., and holding for 8 hours. Extensive tests under varying conditions had shown that either of the above treatments would kill all stages of both the Mediterranean fruit fly and the melon fly. Papaya, avocado, and tomato have been treated commercially by one or both of these treatments in Hawaii. Papayas have been successfully shipped to the mainland of the United States after having been given the heat treatment. Over 200,000 pounds were certified in the fiscal year ended June 30, 1940, nearly 275,000 pounds in the year ended June 30, 1941, and up to December 7, 1941, over 100,000 pounds were certified. Several shipments of avocados were certified under the cold treatment in 1939, but this method of sterilization was apparently abandoned.

The methyl bromide fumigation treatment for guavas, papayas, bell peppers, bitter melon, cucumbers, summer squash, string beans,

¹The Mediterranean Fruit Fly in Hawaii, E. A. Back and C. E. Pemberton. U. S. Dept. Agr. Bul. 536: 109, 1918.

and tomatoes, authorized in B.E.P.Q.-510, effective August 1, 1940, so far has not been used extensively. A few trial shipments of tomatoes given this treatment were made in 1941.

PARCEL-POST INSPECTION

The inspection of parcel-post packages in the Honolulu Post Office before departure for mainland destinations was inaugurated by H. F. Willard, inspector in charge of the Division of Foreign Plant Quarantines, on November 1, 1930. Mr. Willard had been connected with the Bureau of Entomology and the Federal Horticultural Board since 1914, being associated with Dr. Back and C. E. Pemberton, and took over the office of inspector when Mr. Pemberton left to join the Army in 1918. Previously the inspection of such packages had been performed on the West Coast, mainly by collaborators of the Federal Horticultural Board in San Francisco. At the beginning of this new activity Mr. Willard had the assistance of James T. Watt, who was transferred to Honolulu to supervise the per diem employees engaged for this work. A large percentage of the packages were opened and the contents examined, until it became evident that it was not necessary to inspect packages the origin of which would indicate that the presence of contraband plant material was very unlikely. Mr. Willard obtained the cooperation of several Honolulu firms, who agreed to see that no contraband plant material left their stores in packages addressed to the mainland. For many years the Post Office Department had cooperated with the Federal Horticultural Board in impressing on postmasters in Hawaii the importance of compliance with plant quarantine orders. Mr. Willard also obtained publicity through the local papers, which stressed the necessity for care in mailing native plant material to the mainland. A great many objectors to the new procedure called on Mr. Willard to register their protests but he was able to send them away convinced of the need for inspection. Apparently the steps taken in the early years of this phase of plant quarantine inspection were very effective, as there has been a marked decrease in the amount of contraband intercepted.

After December 7, 1941, R. G. Oakley, inspector in charge, arranged with the censorship authorities for the examination of parcel-post packages on a cooperative basis. Under this arrangement plant quarantine inspectors hold up packages containing censorable material and postal censors turn over mail containing plant material to Foreign Plant Quarantine inspectors. This obviously is of mutual benefit and has resulted in numerous interceptions of contraband plant material in first-class mail, which would not ordinarily be available to inspection by plant quarantine officials. Since late in August 1943 over two-thirds of the parcel-post packages inspected in Honolulu pass through the 15th Base Post Office at Fort Shafter, and the rest through the Honolulu Post Office.

During recent years the most frequent interceptions have been of raw cotton in the form of locks and bolls picked and mailed to the mainland, often to southern States, by members of the armed forces. Pink bollworms are frequently found in the seed. A tabulation of interceptions made in parcel post in Honolulu from April 1, 1943, to March 31, 1944, showed nine violations of Quarantine No. 13 (Mediterranean Fruit fly and Melon fly), 13 violations of Quarantine No. 16 (Sugarcane), one violation of Quarantine No. 32 (Banana Plant), and 49 violations of Quarantine No. 47 (Cotton, Cottonseed, and Cottonseed Products).

INSPECTION AND CERTIFICATION OF AIRPLANES

Another important inspection activity of the Division of Foreign Plant Quarantines in Hawaii, inaugurated by Mr. Willard, is the inspection and certification of airplanes departing for the mainland of the United States. This service was set up when the Pan American Airways Inc. began their flights to the Orient in October 1936. It appeared desirable to complete all inspections in Honolulu before the Clippers left the Pearl City airport for the West Coast. L. A. Whitney, collaborator, and Mr. Willard, in cooperation with the United States Public Health Service and the United States Customs, worked out a procedure for handling the inspection of planes arriving from the Orient. The subsequent clearing of the planes when they continued on to the mainland has been the responsibility of the Foreign Plant Quarantines office. Plant quarantine inspectors board the planes before departure to determine their freedom from plant material. Then all baggage and cargo are checked before being taken on board. Certificates are prepared which give the facts as to the condition of the planes. Before the war began a large number of flower leis certified by inspectors of the Territory were frequently carried as air express. The certificates may be picked up at destination by the plant quarantine inspectors, who can check any plant material on board. Pan American Airways officials have cooperated from the start in carrying out the inspection procedure and in instructing their passengers concerning plant quarantine regulations. The inspection and certification of airplanes in Honolulu aims to prevent the carrying of fruits and vegetables that may be infested with injurious insects out of the Territory, instead of intercepting them at destination on the mainland. At the same time it makes unnecessary plant quarantine inspection of baggage upon arrival on the mainland and avoids considerable delay for through passengers who may have very little time to make overland connections.

The Japanese attack on Pearl Harbor on December 7, 1941, caused only a slight break in the certification of Pan American Airways Clippers. One Clipper landed and returned from Hilo,

but the Pearl City base was in use again immediately, although flights were conducted with utmost secrecy. The development of air transport by both Army and Navy, however, has increased the amount of plant quarantine inspection tremendously. Certification of Navy transport planes has been carried on, along with the planes operated for the Navy by P.A.A. The Air Transport Command arranged to house two plant quarantine inspectors at Hickam Field to certify Army planes departing for the mainland, as well as those operated for A.T.C. by United Air Lines and Consolidated Vultee Aircraft Corp.

The amount of contraband plant material intercepted on board planes is not large, considering the number of planes leaving Hawaii for the mainland. This is apparently due to the educational campaign which has been carried on by all concerned to acquaint the public and the Air Force with plant quarantine restrictions. Avocados, papayas, and sugar cane from the Islands are occasionally intercepted.

When the war is over plant quarantine inspectors will no doubt resume the inspection of baggage bound for the mainland, which has been performed by customs inspectors during the war. If the volume of traffic is as large as expected, this will mean a corresponding increase in plant quarantine inspection, a problem which deserves careful study by the Territorial and Federal plant quarantine officers.